AMENDMENTS TO THE SPECIFICATION

Please amend the paragraph beginning on page 4, line 16 and ending at line 30, as follows:

According to a first aspect of the present invention, there is provided an interpolation frame generation device for generating an interpolation frame that interpolates image frames that are obtained by decoding a coded image signal that is coded by motion compensation. The device comprises a motion compensation vector acquisition unit and an interpolation frame generation unit. The motion compensation vector acquisition unit acquires a motion compensation vector of a coded block that forms the coded image signal by decoding the coded image signal. The interpolation frame generation unit generates the interpolation frame in accordance with at least a motion vector of an image block that forms an image frame by using the motion compensation vector of the coded block as the motion vector of the image block.

Please amend the paragraph beginning on page 5, line 30, and ending on page 6 at line 7, as follows:

In this interpolation frame generation device, motion compensation vectors in an image signal that are coded by motion compensation ~~is~~are utilized. The motion vector detection unit performs detection in a certain area of a reference frame that is determined in accordance with the motion compensation vectors when detecting motion vectors. Therefore, the volume of calculation necessary for detecting motion vectors can be decreased.

Please amend the paragraph beginning on page 7, line 7 and ending at line 16, as follows:

According to a fourth aspect of the present invention, in the interpolation frame generation device according to the third aspect, the image signal information includes a motion compensation vector or a coding mode of a coded block that forms the coded image signal~~, and the~~. The partially selected image block is an image block that is determined to be stationary from the image signal information or an image block that is determined to have a movement having low correlation with the adjacent image blocks from the image signal information.

Please amend the paragraph beginning on page 11, line 26, and ending on page 12 at line 4, as follows:

According to an eleventh aspect of the present invention, in the interpolation frame generation device according to the ninth aspect, an interpolation vector derivation unit operable to derive a global motion vector for generating an interpolation frame in accordance with the movement associated information ~~are~~is further provided. The interpolation frame generation unit can generate the interpolation frame in accordance with the global motion vector when the decision is negative.

Please amend the paragraph beginning on page 14, line 26 and ending at line 29, as follows:

According to a sixteenth aspect of the present invention, in the interpolation frame generation device according to any one of the thirteenth through fifteenth ~~aspect~~aspects, the interpolation frame generation unit changes a range in which a motion vector of image block that forms an image frame is detected in accordance with a decision of the generation process ability decision unit.

Please amend the paragraph beginning on page 15, line 21, and ending on page 16 at line 1, as follows:

According to an eighteenth aspect of the present invention, there is provided an interpolation frame generation device for generating an interpolation frame for interpolating image frames. The device comprises a motion vector detection unit and an interpolation frame generation unit. The motion vector detection unit detects at least a motion vector of an image block that forms an image frame via a motion detecting unit of a coding device for motion compensation coding. The interpolation frame generation unit generates the interpolation frame in accordance with the motion vector.

Please amend the paragraph beginning on page 16, line 7 and ending at line 14, as follows:

According to a nineteenth aspect of the present invention, in the interpolation frame generation device according to the eighteenth aspect, operating state decision ~~unit~~units operable to decide an operating state of the motion detecting unit of the coding device are further provided. In addition, the interpolation frame generation unit generates the interpolation frame in accordance with the decided operating state.

Please amend the paragraph beginning on page 16, line 15 and ending at line 22, as follows:

In this interpolation frame generation device, an operating state decision unit determines the operating state, such as whether or not the motion detecting unit is operating, or the quantity of information processing in the motion detecting unit. The interpolation frame generation unit can generate an interpolation frame appropriately in accordance with a margin of processing in the motion detecting unit.

Please amend the paragraph beginning on page 17, line 16 and ending at line 26, as follows:

According to a twenty-second aspect of the present invention, an interpolation frame generation device for generating an interpolation frame that ~~interpolate~~interpolates image frames is provided. The device comprises a motion vector detection unit and an interpolation frame generation unit. The motion vector detection unit detects motion vectors by utilizing a plurality of first image frames that are located either before or after the interpolation frame in the display order. The interpolation frame generation unit generates the interpolation frame in accordance with the motion vectors.

Please amend the paragraph beginning on page 21, line 12 and ending at line 25, as follows:

According to a twenty-eighth aspect of the present invention, there is provided an interpolation frame generation device for generating an interpolation frame for interpolating

image frames. The device comprises an area determination unit and an interpolation frame generation unit. The area determination unit determines an interpolation inadequate area that is not adequate for generating the interpolation frame in an outer frame area of the image frame. The interpolation frame generation unit generates the interpolation frame in accordance with movement associated information about movements of image blocks that form the image frame and performs a special area compensation process for the decided interpolation inadequate area so as to generate the interpolation frame.

Please amend the paragraph beginning on page 27, line 1 and ending at line 17, as follows:

Here, in the image frame decision step, it is decided that the image frame is not adequate for generating an interpolation frame in situations in which dispersion of the movement associated information of the image frame is large, and in situations in which there are many image blocks in which a sum of DCT coefficients of coded blocks that form a coded image signal for decoding the image frame is larger than a certain threshold level~~,~~. Moreover, the image frame is not adequate in situations in which there are many image blocks that are intra coded, ~~in situations in which~~where there are many image blocks in which a sum of absolute differences (SAD) of the image block that is calculated when detecting the motion vector is larger than a certain threshold level, or ~~in situations in which~~where directions of the movement associated information expressed as a vector are changed in the number larger than a predetermined number, for example.

Please amend the paragraph beginning on page 29, line 16 and ending at line 22, as follows:

In this interpolation frame generation method, a motion vector can be detected for an image block that is not included in one image frame located after the interpolation frame in the display order, by using an image frame ~~image frame~~ that is located temporally further from the one image frame. As a result, the accuracy with which an interpolation frame is generated can be improved.

Please amend the paragraph beginning on page 33, line 13 and ending at line 29, as follows:

Here, in the image frame decision step, it is determined that the image frame is not adequate for generating an interpolation frame in situations in which dispersion of the movement associated information of the image frame is large, and in situations in which there are many image blocks in which a sum of DCT coefficients of coded blocks that form a coded image signal for decoding the image frame is larger than a certain threshold level~~,~~. Moreover, the image frame is not adequate for generating an interpolation frame in situations in which there are many image blocks that are intra coded, ~~in situations in which~~where there are many image blocks in which a sum of absolute differences (SAD) of the image block that is calculated when detecting the motion vector is larger than a certain threshold level, or ~~in situations in which~~where directions of the movement associated information expressed as a vector are changed in the number larger than a predetermined number, for example.

Please amend the paragraph beginning on page 37, line 22 and ending at line 24, as follows:

Fig. 1 is a block diagram showing the configuration of an interpolation frame generation device ~~101~~ according to a first embodiment of the present invention;

Please amend the paragraph beginning on page 37, line 25 and ending at line 27, as follows:

Figs. 2A and 2B describe the operation of a motion vector detecting unit ~~103~~ and an interpolation frame generating unit ~~104~~;

Please amend the paragraph beginning on page 39, line 5 and ending at line 7, as follows:

Figs. 16A and 16B describe the operation of a motion vector deriving unit ~~203~~ and an interpolation frame generating unit ~~204.~~;

Please amend the paragraph beginning on page 39, line 17 and ending at line 18, as follows:

Fig. 20 is a block diagram showing the configuration of a decoding device ~~215~~;

Please amend the paragraph beginning on page 39, line 19 and ending at line 22, as follows:

Fig. 21 is a block diagram showing the configuration of an interpolation frame generation device ~~601~~ according to a third embodiment of the present invention;

Please amend the paragraph beginning on page 39, line 23 and ending at line 24, as follows:

Figs. 22A and 22B describe the derivation of a motion compensation vector ~~EV15~~;

Please amend the paragraph beginning on page 40, line 2 and ending at line 5, as follows:

Fig. 25 is a block diagram showing the configuration of an interpolation frame generation device ~~301~~ according to a fourth embodiment of the present invention;

Please amend the paragraph beginning on page 40, line 6 and ending at line 7, as follows:

Fig. 26 is a block diagram showing the configuration of a coding device ~~303~~;

Please amend the paragraph beginning on page 40, line 11 and ending at line 12, as follows:

Fig. 28 describes a margin for a process performed by a motion detecting unit ~~326~~;

Please amend the paragraph beginning on page 40, line 13 and ending at line 16, as follows:

Fig. 29 is a block diagram showing the configuration of an interpolation frame generation device ~~621~~ according to a fifth embodiment of the present invention;

Please amend the paragraph beginning on page 40, line 17 and ending at line 18, as follows:

Figs. 30A and 34B describe the generation of an interpolation frame ~~CF640~~;

Please amend the paragraph beginning on page 40, line 19 and ending at line 20, as follows:

Figs. 31A-31D describe area compensation for a pixel area ~~646~~ on the interpolation frame ~~CF640~~;

Please amend the paragraph beginning on page 40, line 26 and ending at line 29, as follows:

Fig. 34 is a block diagram showing the configuration of an interpolation frame generation device ~~651~~ according to a sixth embodiment of the present invention;

Please amend the paragraph beginning on page 41, line 3 and ending at line 5, as follows:

Fig. 36 is a block diagram showing the configuration of an interpolation frame generation device ~~701~~ according to a seventh embodiment of the present invention;

Please amend the paragraph beginning on page 41, line 6 and ending at line 7, as follows:

Fig. 37 describes an interpolation inadequate area ~~716~~ and an interpolation adequate area ~~717~~;

Please amend the paragraph beginning on page 41, line 8 and ending at line 9, as follows:

Fig. 38 describes the operation of a motion vector detecting unit ~~704~~;

Please amend the paragraph beginning on page 41, line 10 and ending at line 11, as follows:

Fig. 39 describes the operation of an interpolation frame generating unit ~~705~~;

Please amend the paragraph beginning on page 41, line 12 and ending at line 14, as follows:

Fig. 40 is a flowchart showing an interpolation frame generation method according to the seventh embodiment of the present invention~~.~~;

Please amend the paragraph beginning on page 41, line 15 and ending at line 18, as follows:

Fig. 41 is a block diagram showing the configuration of an interpolation frame generation device ~~751~~ as a modification of the seventh embodiment of the present invention;

Please amend the paragraph beginning on page 41, line 19 and ending at line 20, as follows:

Fig. 42 describes the operation of an interpolation inadequate area acquisition unit ~~753~~;

Please amend the paragraph beginning on page 41, line 21 and ending at line 23, as follows:

Figs. 43A and 43B describe the operation of the motion vector detecting unit ~~704~~ as a modification of the seventh embodiment of the present invention;

Please amend the paragraph beginning on page 41, line 24 and ending at line 26, as follows:

Figs. 44A-44C describe the operation of the motion vector detecting unit ~~704~~ as a modification of the seventh embodiment of the present invention~~.~~;

Please amend the paragraph beginning on page 41, line 27 and ending at line 29, as follows:

Fig. 45 describes the operation of the interpolation frame generating unit ~~705~~ as a modification of the seventh embodiment of the present invention;

Please amend the paragraph beginning on page 41, line 30, and ending on page 42 at line 3, as follows:

Fig. 46 is a block diagram showing the configuration of an interpolation frame generation device ~~801~~ as a modification of the seventh embodiment of the present invention;

Please amend the paragraph beginning on page 42, line 4 and ending at line 5, as follows:

Figs. 47A and 47B describe an effect of the interpolation frame generation device ~~801~~;

Please amend the paragraph beginning on page 42, line 14 and ending at line 16, as follows:

Fig. 52 is a block diagram showing the configuration of a conventional interpolation frame generation device ~~401~~; and

Please amend the paragraph beginning on page 42, line 17 and ending at line 18, as follows:

Fig. 53A and 53B describe the conventional generation of an interpolation frame~~;~~.

Please amend the paragraph beginning on page 50, line 28, and ending on page 51 at line 10, as follows:

Fig. 6A shows the reference frame RF156, the reference frame RF157 and the base frame BF158 stored in the frame memory 102 (see Fig. 1). Using these three image frames, an interpolation frame CF159 (see Fig. 6B) that ~~interpolate~~interpolates between the reference frame RF157 and the base frame BF158 is generated. When this occurs, motion vectors MV160 and MV161 of the image blocks that form the base frame BF158 are used for the reference frame

RF156 and the reference frame RF157. More specifically, when generating the interpolation frame CF159, the interpolation motion vectors CMV162 and CMV163 that are derived respectively by internal division of the motion vectors MV160 and MV161 are used.

Please amend the paragraph beginning on page 63, line 14 and ending at line 21, as follows:

Fig. 14A shows detected motion vectors MV31-MV42 for image blocks BL31-BL42 of a base frame BF551. Here, when correcting motion vectors of image blocks that form the base frame BF551, the image blocks are thinned out in a checkerboard pattern for the base frame BF551 in advance, and the -motion vectors of the ~~remained~~remaining image blocks are used for correcting image blocks so that motion vectors of all image blocks are corrected.

Please amend the paragraph beginning on page 63, line 22 and ending at line 29, as follows:

Fig. 14B shows the state in which the image blocks are thinned out in a checkerboard pattern for the base frame BF551. Here, a situation will be described in which motion vectors MV31, MV33, MV35, MV37, MV39 and MV41 of the ~~remained~~remaining image blocks BL31, BL33, BL35, BL37, BL39 and BL41 are used for image blocks so that corrected motion vectors are derived for the image block BL36 and the image block BL37.

Please amend the paragraph beginning on page 64, line 7 and ending at line 18, as follows:

For a second example, corrected motion vectors for the thinned-out image block BL37 are derived performing the correction process using the above-mentioned linear smoothing filter, adaptive smoothing filter or other nonlinear filters for the motion vectors MV33, MV36, MV38 and MV41 of surrounding image blocks. In addition, any one of the motion vectors MV33, MV36, MV38 and MV41 of the surrounding image blocks may be duplicated to be the corrected motion vector. Here, one of ~~the~~ image blocks BL33, BL36, BL38 and BL41 that has a minimum sum of absolute differences (SAD) is selected as the image block to be the original of duplication, for example.

Please amend the paragraph beginning on page 65, line 22, and ending on page 66 at line 1, as follows:

In Sections (4-12) and (4-13) above, if motion vectors are detected for different reference frames as the motion vectors of adjacent image blocks, it is possible that the weight coefficients of the smoothing filters vary in accordance with the temporal distance between the base frame and each of the reference frames. In addition, it may ~~be~~ also be possible to perform the correction process for the interpolation motion vector obtained by internal division or external division of each of the motion vectors.

Please amend the paragraph beginning on page 83, line 1 and ending at line 10, as follows:

The interpolation frame generating unit 604 derives interpolation motion vectors for each of the image blocks from motion compensation vectors of a general image ~~blocks~~block and corrected motion compensation vectors of specific image blocks, and then ~~generate~~generates an interpolation frame. More specifically, an interpolation motion vector is derived in the same way as described in the second embodiment except ~~for~~ that the interpolation motion vectors are derived by using the corrected motion compensation vectors for the specific image blocks.

Please amend the paragraph beginning on page 92, line 14, and ending on page 93 at line 4, as follows:

Here, the operation of the coding unit 323 will be described with reference to Fig. 26. The coding unit 323 includes an orthogonal transformation unit 340, a quantization unit 341, a variable length coding unit 342, ~~a~~an inverse quantization unit 343, and ~~a~~an inverse orthogonal transformation unit 344. A situation will be described in which the coding unit 323 performs MPEG coding. The input image signal 321 is sorted in order for coding and then converted into DCT coefficients by the orthogonal transformation unit 340. The quantization unit 341 quantizes the DCT coefficients. The quantized DCT coefficients are coded together with the motion compensation vector and the coding mode obtained from the motion compensation unit 324 by the variable length coding unit 342 with variable length coding, so as to be delivered as the coded

image signal 322. Information that is used for motion compensation among the quantized DCT coefficients ~~are~~is decoded by the inverse quantization unit 343 and the inverse orthogonal transformation unit 344 and ~~are~~is stored in the frame memory 325 of the motion compensation unit 324.

Please amend the paragraph beginning on page 104, line 24, and ending on page 105 at line 10, as follows:

In the fifth embodiment of the present invention, the interpolation frame generation device 621 generates the interpolation frame CF640 by moving the base frame BF641 in parallel by one interpolation motion vector CMV642. Since it is not necessary to derive interpolation motion vectors for all of image blocks that ~~forms~~form the base frame BF641, the volume of calculation is decreased. In addition, since the base frame BF641 is moved by one interpolation motion vector CMV642, image distortion in the interpolation frame CF640 is reduced. In addition, since the base frame BF641 is moved by one interpolation motion vector CMV642 for generating the interpolation frame CF640, it is not necessary to move each of the image blocks by the interpolation motion vector for each image block that forms the base frame BF641. Therefore, the volume of calculation for generating an interpolation frame is decreased.

Please amend the paragraph beginning on page 105, line 11 and ending at line 16, as follows:

In addition, ~~A~~a situation in which an image with shaking, e.g., an image that was taken by a video camera is stored, a movement of the entire image is captured for generating the interpolation frame. Therefore, impression of the image becomes smooth, and shaking of the image that causes hard observation is reduced.

Please amend the paragraph beginning on page 119, line 19, and ending on page 120 at line 4, as follows:

In the above (1-1), it is possible that the vector conversion unit 659 does not derive a global motion vector, and the image decision unit 662 decides whether or not the smoothed vectors, or both the corrected motion compensation vectors of the specific image blocks and the

motion compensation vectors of the general image blocks are adequate for the generation of an interpolation frame. In the case where it is decided that these vectors are not adequate for the generation of an interpolation frame, the vector conversion unit 659 ~~derive~~ derives the global motion vector. Furthermore, the image decision unit 662 decides whether or not the global motion vector is adequate for the generation of an interpolation frame by using the method (v) - (vi) described in Section (1-2) above. Thus, the volume of calculation for deriving the global motion vector can be decreased.

Please amend the paragraph beginning on page 128, line 25, and ending on page 129 at line 1, as follows:

Furthermore, in the above embodiment, a situation was described in which the interpolation frame CF726 is generated by the base frame BF715 whose aspect ratio is converted by the letter box method. However, the present invention can ~~be~~ also be applied similarly to a situation in which the base frame BF715 is converted in its aspect ratio by the side panel method.

Please amend the paragraph beginning on page 136, line 30, and ending on page 137 at line 5, as follows:

Therefore, an outside reference area 781 that is an area obtained by enlarging the interpolation adequate area 780 of the reference frame RF776 outward is referred so that the motion vector is detected. The enlarged area is obtained by duplicating ~~pixel~~ pixels located at the outer rim of the interpolation adequate area 780 outward (see Fig. 44C).